

## **Trade and Development Board**

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### **Interdependence and global economic issues from a trade and development perspective: regional cooperation for development**

## **Recent developments on global financial markets**

**Note by the UNCTAD secretariat**

### *Executive summary*

Turmoil on the financial markets is back. After several years of relative calm, uncertainty and apprehension among market participants have prompted aggressive action by policymakers in a number of developed economies. In the first round, the massive provision of liquidity by several central banks in an attempt to keep interest rates at their target levels has calmed down financial markets after the first shock waves of the so-called sub-prime mortgage crisis had hit banks in Europe and the United States of America. Most recently, the cut of 50 basis points from policy interest rates by the United States Federal Reserve on 18 September has shown that policymakers are ready to stabilize the real economy and prevent a major breakout of financial panic.

However, something fundamental seems to be wrong with a financial system that cannot survive for more than three or four years without facing damaging or at least an unsettling crisis. Apparently, recurrent episodes of financial volatility are driven by financial firms' attempts to extract consistent double-digit returns out of a real global economic system that manages to grow only at rates in the lower single-digit area. This kind of financial alchemy is based on massive leverage and opaque instruments which confuse naïve market participants about the risks they take. Time and again a reality check, normally triggered by central banks through rising interest rates, leads to recurrent crises driven by the need to realign the value of financial assets with that of the underlying real assets.

Nobody would deny that financial services play a key role in allocating funds to high-return activities, but the frequency of crisis suggests that only regulated financial markets will yield the best possible outcome. This has important implications both in the advanced financial markets and in emerging markets under pressure to increase financial openness and to promote deregulation. Effective regulation can help to sustain finance and can initiate innovative financial engineering while preventing excessive risk-taking that may negatively affect not only the financial market agents but a much wider constituency.

While the short-term response to the recent financial turmoil has so far proven appropriate, long-term policy responses for developed and developing countries alike require wider and deeper reflection. Obviously, lack of transparency

is at the root of the current crisis. This is mainly due to the fact that instead of spreading risk in a transparent way as foreseen by economic theory, market operators chose ways to “securitize” risky assets by spreading high-yielding assets without clearly marking their risk. Additionally, credit-rating agencies failed to understand these products, and the fact that they were rarely traded led to a situation where even the approximate value of these structured financial products was not known.

This note emphasizes that the current light regulatory stance creates a bias in favour of “sophisticated” but opaque financial products and encourages banks to operate through lightly supervised affiliates and “special purpose vehicles”. Such a bias should be corrected by adopting regulations that favour simpler and more transparent financial products and do not allow banks to engage in risky off-balance-sheet activities. Certainly, recent events should give developing countries pause to reflect on what path of financial sector development and what level of sophistication is most suited to their level of development.

The note also discusses the role of credit-rating agencies. Financial regulation makes rating decisions important in establishing what assets can be held by certain types of financial intermediaries. The need to obtain a rating shields rating agencies from market discipline that would force them to increase the accuracy of their ratings. At the same time, rating agencies cannot be held legally accountable for their decisions because they claim that their ratings are only opinions and not accurate predictions of the risk of a given instrument. This problem could be solved by establishing a regulatory agency which would supervise the role of credit-rating agencies. So, just as federal food and drug authorities have to certify the safety of a given pharmaceutical products, such an agency could certify that AAA assets have indeed minimal probability of default.

What happens next, very much depends on how the sub-prime mortgage crisis proper, the solvency crisis of many private households, is going to affect growth of the United States economy and whatever similar pressures build in European economies (the United Kingdom and Spain are noted as potentially fragile markets in this respect). Over the last decade, the United States has accumulated large current account deficits driven mainly by high consumption of private households. In turn, the consumption boom was fed by easy access to credit partly driven by mortgage-refinancing. A collapse in housing prices can lead to a sudden reversal of this situation and cause a contraction in United States consumption which, over the last few years, has also been one of the main drivers of world demand. This could be part of the mechanism that, together with a fall of the dollar, kick starts the unwinding of global imbalances. However, if the dollar fall is not controlled by Governments and central banks, the consequences for the global economy may be dire. This note examines three possible scenarios and highlights potential repercussions for developing countries.

Hence, beyond the recent short-term actions, longer-term vigilance of monetary policy is needed. While bailing out of single players is a dubious path, policymakers should stand ready to mitigate the macroeconomic effects of the crisis and prevent contagion. Once better information about the most vulnerable parts of the financial system is available, the European Central Bank, United States Federal Reserve and other major central banks should be able to normalize liquidity supply without endangering their interest rate and inflation targets. The

bottom line is that liquidity problems should not be allowed to amplify or mask any solvency problems that may be at the root of the crisis. The real challenge, however, is to devise long term policies for the financial markets that penalize those responsible for causing the crisis while protecting innocent bystanders

## I. Economic background of the liquidity crunch

1. For precautionary and regulatory reasons, all banks need to maintain a certain amount of liquid reserves. This is costly as reserves are not remunerated in the United States of America and pay below-market interest rates in Europe. In order to minimize the amount of reserves they hold, banks engage in lending and borrowing activities amongst themselves in the inter-bank market. The inter-bank market normally efficiently allocates excess liquidity and acts like the central nervous system of the financial sector.

2. A small glitch in the inter-bank market can lead to a liquidity crisis. In early August 2007, United States banks held approximately \$12 billion of reserves deposited in accounts with the United States Federal Reserve System. During an average day, these \$12 billion of reserves are used to make daily inter-bank transfers amounting to approximately \$4 trillion. This implies that, on average, a dollar in reserves changes hands 300 times per day.<sup>1</sup> A change in this large multiplier driven by banks' desire to hoard reserves can lead to an enormous drop in liquidity.

3. Banks lend in the inter-bank market and keep their reserves at a minimum because they know that when they need reserves they can borrow them again. However, if banks take the view that they may not be able to access the market, they will start hoarding reserves which will reduce available liquidity. Like in a bank run, the process might be self-fulfilling. If, for some reason, banks expect a liquidity crisis, they will stop lending in the inter-bank market and the liquidity crunch will emerge.<sup>2</sup>

4. While the problems may have originated in the United States sub-prime mortgage market, the trigger of the recent crisis was a sudden drop in liquidity in the European inter-bank market (see annex A for a chronology of events). The driver of this liquidity shortage was a deterioration in the market for Asset Backed Commercial Papers (ABCP) issued by European structured investment vehicles (SIV, see annex B).<sup>3</sup> The collapse in the market for ABCP followed several weeks of news revealing increasing problems with United States sub-prime mortgages

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1 This discussion is based on Cecchetti (2007) Federal Reserve policy actions in August 2007: frequently asked questions (updated) <http://www.voxeu.org/index.php?q=node/466>

2 In the recent crisis, banks rushed out of the inter-bank market and started hoarding short-term United States Treasury bill leading to a dramatic drop in yield of these instruments. In tranquil times the yield on United States treasury bills is close to that of the Fed Funds rate (the United States inter-bank market). At the peak of the crisis, the yield on Treasury bills was 200 basis points lower than the Fed Fund Rate.

3 The crisis started with a liquidity crisis in the German bank IKB. In July 2007, IKB's conduit Rhineland Funding had an outstanding stock of approximately €20 billion of ABCP. When, in mid-July, investors refused to rollover part of Rhineland Funding's ABCP, the conduit asked IKB to provide a credit line. IKB revealed of not having enough cash or liquid assets to meet the request of its conduit and was saved by a €8 billion credit facility provided by KfW. But the intervention of KfW, rather than stopping the panic led to reserve hoarding and to a run on all commercial paper issued by SIVs.

packaged into collateralized debt obligations (CDO),<sup>4</sup> in particular with the AAA tranche of mortgage backed CDOs (see annex C).

5. As the collapse of the inter-bank market can lead to the disintegration of the whole financial system, central banks provided massive injections of liquidity to support the normal functioning of the inter-bank market during August 2007.<sup>5</sup> One problem with these interventions was that most European banks were seeking dollar liquidity (most expiring ABCP are denominated in United States dollars) and the European Central Bank (ECB) could only provide euro liquidity.

6. One surprising element of the current crisis is that it was driven by a sudden collapse in confidence of CDOs which supposedly enjoyed AAA ratings. Such high-quality financial instruments should carry no default risk and should be sold at a premium (not at a discount) during periods of financial turmoil. The problem with CDOs is that once issued, they are rarely traded. Thus, their valuations, rather than being market-driven, are often based on complicated theoretical models. When CDO holders needed liquidity to face the recent market turmoil, they found out that the market value of their CDOs was well below their book value. Hence, instead of generating liquidity by selling CDOs, they sold high-quality liquid equities. Therefore, the crisis led to a loss of value in both CDOs and liquid equities. The drop in price of liquid equities was the source of contagion to hedge funds. This price behavior was not predicted by the theoretical models built into quantitative hedge funds (Quants) and led to large losses in this segment of the market (see annex C). Significant losses by leading hedge funds further contributed to increasing uncertainty and amplified the crisis.

7. While a drop in housing prices and a wave of defaults in the sub-prime market was widely expected and anticipated, the speed of price adjustments in some segments of the financial market took everybody by surprise, and created rapid adjustments to positions amongst market participants. After all, the first wave of losses in the sub-prime market was estimated at around \$35 billion, which corresponds to about 0.2 per cent of the value of the United States stock market. Subsequent estimates have indicated over \$100 billion of losses, less than one per cent of United States GDP.<sup>6</sup> This is less than half of the impact of the Savings and Loans crisis, which occurred in the United States in the late 1980s and had an estimated cost of 2.5 per cent of United States GDP.

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4 For a detailed discussion of the United States sub-prime mortgage crisis see John Kiff and Paul Mills (2007) "Money for nothing and checks for free: recent developments in U.S. sub-prime mortgage markets," IMF Working Paper 07/188. <http://www.imf.org/external/pubs/cat/longres.cfm?sk=21200.0>

5 On Thursday 9 August 2007, the ECB injected €95 billion in the European financial system, the following day added €48 billion and on Monday another €25 billion. During the same day for the first European intervention, the United States Federal Reserve injected \$24 billion in the United States financial system, followed by a \$38 billion intervention on Friday 10 August and \$2 billion on Monday 13 August. On 17 August the Fed lowered the discount rate by 50 basic points (from 6.25 per cent to 5.75 per cent, 50 basic points above the Fed Funds rate which remained at 5.25 per cent) and accepted mortgage backed securities as collateral for discounting.

6 Even though AAA tranches of CDOs are booking large losses, this looks like a liquidity rather than a solvency problem. Consider the following example. Consider a CDO with a face value of \$100 million with a AAA tranche that covers 90 per cent of the loans included in a CDOs and assume that 20 per cent of mortgages packaged in the CDO go in default (this seems to be a very high default rate). The holders of the AAA tranche will receive \$80 million (the non defaulted loans). Next, the assets that are backing the defaulted mortgages will be foreclosed and holders of the AAA tranche will be the first to be paid. As long as the foreclosure processes on houses that are valued \$20 million yield at least \$10 million, holders of the AAA tranche will have no capital loss.

8. Why is an important, but relatively circumscribed, problem causing so much pain? There are two possible explanations. The first explanation is that the problem could be larger than originally assumed. Along similar lines, investors may think that, just as in the recent past financial markets overshot on the way up, in the deleveraging process they may overshoot on the downside, with amplifying effects coming from automated trading models adopted by Quants.

9. The second explanation is that loan securitization, which was supposed to disperse and allocate risk to those who are better equipped to bear it, led to a situation in which nobody knows where the risk is. It is this uncertainty of which institution will be the next one to be affected by a default that generated the current panic attack and the ensuing liquidity crisis. The fact that after two months since the sub-prime crisis first emerged with force, the full extent of risk and possible loss has yet to be revealed, suggests that the operation of the loan securitization market deserves greater scrutiny than it has so far received.

## **II. Has securitization made things worse?**

10. In a security-based system, banks originate loans but then sell these loans to investors that should be better equipped to bear the risk. Such a system is supposed to be superior to the bank-based system because, by slicing and dispersing risk, it should increase the resilience of the financial system and isolate banks from costly defaults. However, the recent sub-prime mortgage crisis highlights that there may be several problems with securitization.

11. First, it is not clear whether the system was successful in isolating banks from market turbulence. Several structured products are now owned by non-bank institutions (such as SIVs) that have implicit or explicit guarantees from their parent banks. When these non-bank institutions face problems, parent banks need to step in (see annex B). Unlike banks, non-bank institutions are not supervised. Moreover, since SIVs' liabilities are not guaranteed and SIVs do not have access to a lender of last resort that can create liquidity, non-banks are subject to runs. Therefore, in the recent crisis securitization did not isolate banks and, by increasing the opaqueness of the system, may have made things worse.

12. Second, one of the purported advantages of a market-based system is price discovery and the ability to mark assets to market. The problem is that most structured instruments (especially CDOs) are rarely traded and their valuations are not based on market prices but on theoretical models. Such model-based valuations are highly subjective and proved to be too optimistic when the instruments had to be traded. Sophisticated structured products are difficult to understand, and investors may have no idea of the risk they are assuming. Several money market mutual funds (MMMF) are heavily invested in CDOs based on packages of sub-prime loans but few retail holders of MMMF are aware of this fact. Hence, a system that was supposed to be more transparent than the bank-based system may have ended being more opaque.

13. Third, in a bank-based system it is known who holds the risk (i.e., the banks). In an opaque market-based system it is not known where the risk resides. In its most recent report (June 2007), the Bank for International Settlements states:

“Assuming that the big banks have managed to distribute more widely the risks inherent in the loans they have made, who now holds these risks, and can they

manage them adequately? The honest answer is that we do not know. Much of the risk is embodied in various forms of asset-backed securities of growing complexity and opacity. They have been purchased by a wide range of small banks, pension funds, insurance companies, hedge funds, other funds and even individuals, who have been encouraged to invest by the generally high ratings given to these instruments. Unfortunately, the ratings reflect only expected credit losses, and not the unusually high probability of tail events that could have large effects on market values” (p. 145).

14. As holders of risk are *a priori* unknown, this state of affairs generates a climate of deep uncertainty (this is so-called “Knightian uncertainty”, i.e., unknown and immeasurable risk, and not the measurable risk, based on well-defined probability distributions used by financial sector specialists). Uncertainty was at the basis of the recent turmoil which led to the collapse of the inter-bank market. Banks are wary of lending because they do not know who holds the risk. Moreover, as derivatives and CDOs are complex and new instruments, market participants are not able to use past information to form expectations on how these instruments will behave under stress. Uncertainty leads market participants to make decisions based on worst-case scenarios and hoard liquidity in the same way in which people hoard bottled water and canned food when they expect a war.<sup>7</sup>

15. Fourth, banks are more careful in evaluating risk when they plan to keep a loan in their books. If they plan to sell the loan, they worry less about the creditworthiness of the borrower. Hence, securitization may lead to laxer credit standards and to a deterioration of credit quality. It is reasonable to assume that in the absence of securitization several sub-prime loans would have never been extended.<sup>8</sup>

16. Fifth, securitization severs the relationship between lenders and borrowers. With traditional banking, borrowers that are unable to service their debt may be able to reach a rescheduling agreement with the bank (the bank may be willing to do so because foreclosing an asset is costly). When loans are packaged into securities, reaching such agreements is more difficult. Thus, missed payments are more likely to lead to foreclosing. This increases the cost of default for both lenders and borrowers and may also accelerate the drop in asset prices because it increases the number of foreclosures.

17. The sixth problem is related to the previous one. With traditional banking, lenders have privileged information about the quality of the loan. This may make the bank willing to hold the loan and support the market even during periods of market turmoil. With securitization, credit risk has moved from knowledgeable bankers who originated the credit and know its value to institutions with limited knowledge of the origin of the credit. Thus, securitization may increase herding and accentuate market swings as holders of structured instruments will all sell assets during periods of market turmoil.

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<sup>7</sup> For a theoretical discussion of these issues see R Caballero and A Krishnamurthy, “Collective risk management in a flight to quality episode”, forthcoming in *The Journal of Finance*.

<sup>8</sup> This is a negative fact from the point of view of financial stability, but it may also have positive implications because securitization allows access to credit to segments of the populations which were previously excluded from the credit market (it is estimated that securitization reduced borrowing rates by approximately 200 basis points). However, there could be systems to grant access to credit to poor segments of the population that do not involve an increase in financial fragility.

18. Of course, there are still several arguments in favour of a market-based system. Among other things, it may be better to have opaque but spread risk rather than having all risk concentrated in a few institutions. The problem is that securitization may lead to a loss of information. Supporters of securitization argue that the loss of loan-specific information is compensated by the fact that the behavior of packaged loans can be predicted using statistical techniques. In a sense, the law of large numbers is seen as a substitute for loan-specific information. The problem is that standard probability distributions do not work well during periods of market turbulence, and this is exactly the time when information is most valuable. The fact that we keep observing 25 standard deviation events (i.e., events that should happen only once in 100,000 years, see annex D for a short discussion of such “black swan” events) is probably driven by the fact that probability models used to evaluate the risk of packaged debt do not fully account for the fact that during panic episodes shocks become highly correlated and that the effects of the various shocks feed into each other into a vicious circle which implies a massive process of deleveraging which is not built in standard models.<sup>9</sup>

### III. Amplifying factors: carry trade and currency misalignments

19. Currency carry trade is a speculative financial operation that consists of borrowing in low-yielding currency, lend in a high-yielding currency, and make profits on the interest rate differential and, possibly, on exchange rate variations.<sup>10</sup>

20. Although UNCTAD has repeatedly pointed out that carry trade plays a negative role because it prevents a smooth adjustment of the exchange rate and a correction of the current account imbalances, there are also risks in abruptly stopping the trade. A rapid unwinding of carry trade positions could lead to large swings in exchange rates and contribute to financial instability. The current turmoil that originated in the United States sub-prime credit market can affect carry trade operations and be amplified by sudden carry trade unwinding (annex E shows examples of carry trade unwinding).

21. Carry trade positions in the world market have been estimated to about \$1 trillion. Such operations had a role in the determination of exchange rates, market volatility, and flows of liquidity to the United States and several emerging markets (*Trade and Development Report, 2007*). This implies that a massive reversal of positions can be a critical factor in the worldwide financial crisis and liquidity crunch. Therefore, carry trade speculations not only prevent the exchange rate adjustment mechanism from working in the proper way, leading to divergent real exchange rates and global imbalances, but they also increase the fragility of the world financial system, by making economies prone to reversal of market sentiments and liquidity crisis. Thus, carry trade may contribute to financial instability both when it builds up and when it unwinds.

<sup>9</sup> For instance, the drop in housing prices leads to defaults of sub-prime loans, this leads to foreclosures and further contributes to lower home prices and defaults on sub-prime mortgages and then on credit card debt.

<sup>10</sup> As discussed in chapter 1 of the *Trade and Development Report, 2007*, this operation has affected both high income economies such as Australia, Iceland, Japan, New Zealand, Switzerland and the United States, and a few emerging market and transition economies such as Brazil, Bulgaria, Hungary, Romania and Turkey.

#### IV. What will happen to emerging markets?

22. Over the last five years, developing countries have recorded rapid growth, averaging about 6.5 per cent per year. A recession in the United States and a sudden jump in risk aversion could have a large negative impact on emerging markets (EM). The main transmission mechanisms would be a sudden drop in demand for developing countries' exports coupled with a large change in international investors' appetite for EM assets. The emphasis is on change because either a sudden drop or a sudden increase in the demand for EM assets could be problematic. A sudden stop episode could lead to a crisis similar to that which hit emerging market countries in 1998. A sudden increase in capital flows to emerging market countries, instead, would have positive effects in the short run but potentially large negative effect in the long run because it could lead to an appreciation of the real exchange rate (and hence loss of competitiveness) and possibly to a bubble in emerging market assets.

23. What will happen next will depend on the magnitude of the United States crisis. Over the last decade, the United States has accumulated increasingly larger current account deficits driven by high consumption and, in the recent past, large public sector deficits. In turn, the consumption boom (which last year culminated in negative household savings, i.e., a situation in which United States households consumed more than they earned) was fed by easy access to credit driven by the fact that, thanks to increasing housing prices, United States consumers have been able to obtain financial resources by continuously refinancing mortgages. Thus, household debt increased in parallel with the increase in housing prices. A collapse in housing prices can bring to a sudden reversal of this situation and lead to a slackening of United States consumption which, over the last few years, has been one of the main drivers of United States and world demand. Given the high public sector deficit, a fiscal expansion is unlikely to compensate a decline in consumption. Thus, a collapse in housing prices could be one of the mechanisms that kick-starts the unwinding of global imbalances. If this unwinding happens to be chaotic the consequences for the global economy will be dire.

24. Three different scenarios may be envisaged: (i) a *benchmark scenario* characterized by a mild growth slowdown in the United States; (ii) a *benign scenario* with limited impact on the United States and world economy; and (iii) a *crisis scenario* characterized by a full-blown recession in the United States and a sudden jump in investors' risk aversion.

25. In the **benchmark scenario**, the United States would go into a mild recession and investors' risk aversion increases but remains low. Developing countries could either benefit or suffer in such a scenario. In general, they would suffer from the reduced demand for their exports and lower commodity prices, but they may gain from the drop (or lower than expected increase) in interest rates which would probably be associated with a slow down of the United States economy.<sup>11</sup> If demand in the rest of the world remains strong, the beneficial effect of the second factor may dominate the negative effect of the first factor.

26. The benchmark scenario is based on the rule of thumb that, in the United States, a \$1 drop in housing wealth leads to a 0.06 per cent decline in consumption.

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<sup>11</sup> An increase in risk aversion would have a negative effect on most developing countries, but there will be regional differences in the magnitude of this negative effect. Liquidity might become an issue for those countries which are running current account deficits and did not accumulate enough international reserves.

As most estimates suggest a 10 per cent correction in United States housing prices, the ensuing drop in private consumption could lead to a 1 per cent decline in United States GDP growth. IMF estimates suggest that “shocks to the United States economy have significant implications for growth in all other regions. The spillovers are roughly  $\frac{1}{4}$  to  $\frac{1}{2}$  as large as the disturbance in United States growth”.

27. In the **benign scenario**, interventions by the major central banks are successful, the current crisis dissipates quickly and both the advanced economies and emerging markets keep growing (possibly at a slightly lower rate than expected). In this scenario, the CDOs market would have successfully passed its first *stress test*, and asset markets in both developing and advanced economies would benefit from lower than expected interest rates.

28. It is possible however, that the sub-prime crisis will become a full-blown financial market crisis *cum* recession. In this **“perfect-storm” or crisis scenario**, the United States goes into a full-blown recession and, as happened in 1998, risk aversion skyrockets. Under this scenario, emerging markets would receive negative shocks on both the real (because of reduced demand for their exports) and financial sides (because of considerably higher spreads). Since most emerging market countries are now running current account surpluses, the crisis would not be as painful as the one that hit the emerging world in 1998. However, it could be painful for the small group of countries in East Europe and Central Asia, which are running large current account deficits. A perfect storm may even cause financial problems to some emerging countries that are running current account surpluses.<sup>12</sup>

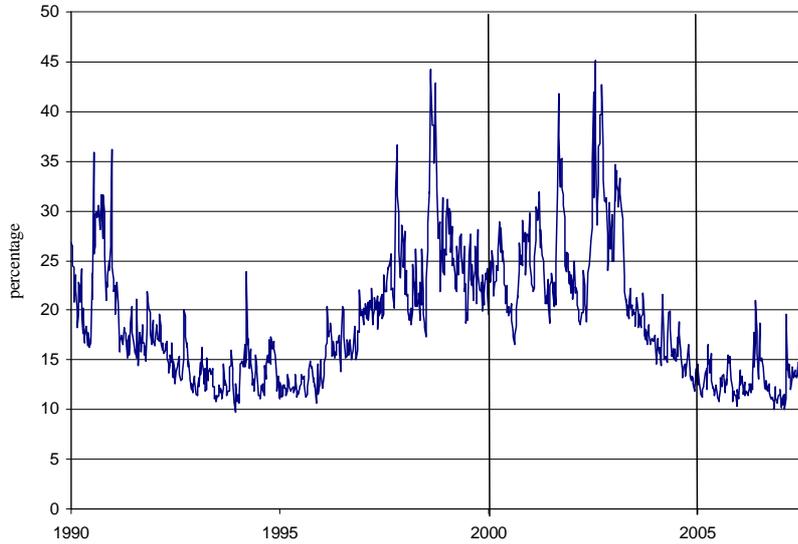
29. One of the biggest risks of the current crisis is a sudden jump in risk aversion. Markets are clearly nervous, expected volatility of United States equities (measured by the VIX index) has increased from historical lows to 30, but remains well below the levels reached during the 1998 Russian Crisis and also lower than the levels prevailing in 2002-2003 (fig. 1). On the positive side, markets do not seem to be pricing a run from emerging market assets. EMBI+ spreads have increased but remain at very low levels and much lower than the level reached during the Asian and Russian crises (fig. 2 and annex G). Spreads of United States high-yield (junk) bonds also increased but remain low (fig. 3). Interestingly, the increase in spreads of United States junk bonds was higher than that on emerging market bonds (160 basis points corresponding to a 53 per cent increase, versus 56 basis points, corresponding to a 33 per cent increase), indicating that, so far, contagion has been limited.

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<sup>12</sup> Calvo and Talvi (2006), “The resolution of global imbalances: soft landing in the North, sudden stop in emerging markets?”, point out that 18 per cent of countries that suffered a sudden stop in the 1980–2005 period were running a current account surplus.

**Figure 1. Expected volatility of United States stocks as measured by the VIX Index**

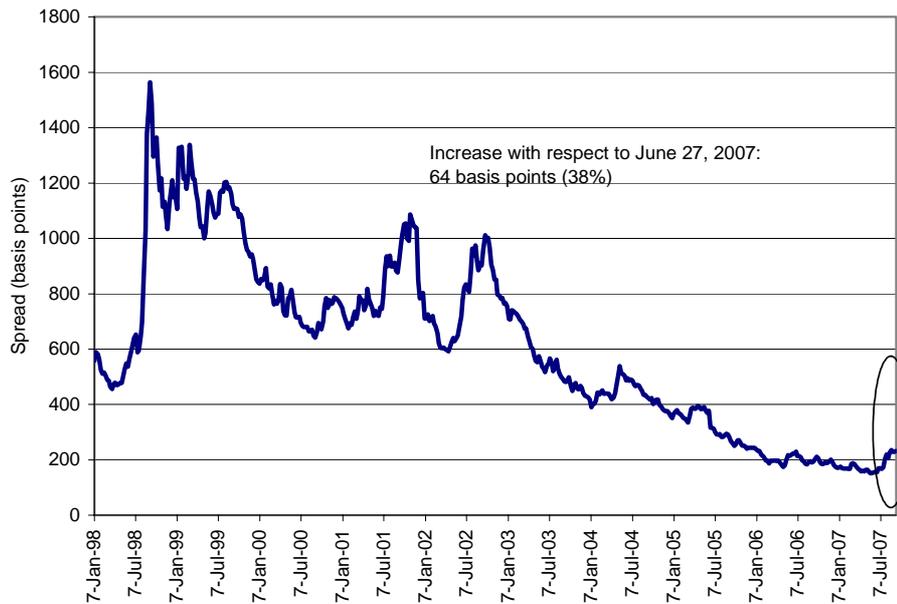
(January 1990–17 September 2007)



Source: UNCTAD secretariat calculations based on Thomson Financial Data Stream.

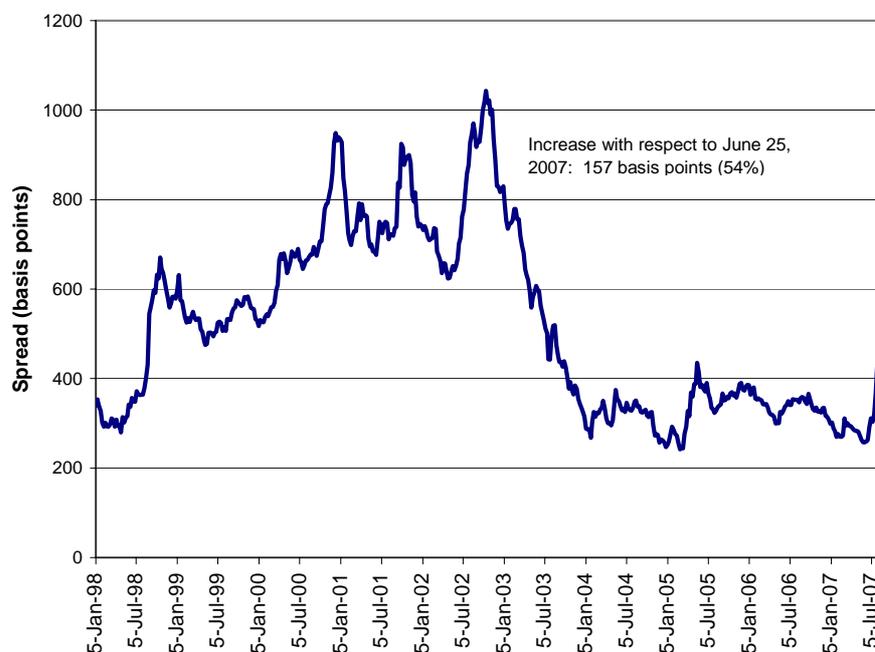
**Figure 2. Emerging market spreads (JPM EMBI + composite spread)**

(Weekly data from January 1990–12 September 2007)



**Figure 3. United States high-yield bond spreads (Lehman high-yield spread)**

(Weekly data from January 1990–17 September 2007)



### Regional repercussions

30. In general, the size of the regional repercussions will depend on two factors: the size of the shock to the United States economy and the linkages between the various developing regions and the United States. The importance of the second factor could be reduced by increasing the reliance on south-south trade and integration and reducing the reliance on the markets of the advanced economies.<sup>13</sup>

31. By early September, the following indication of regional ripples of the turmoil in developed economies' financial markets could be gauged.

#### Latin America

32. Latin American has close links with the United States markets and a crisis in the United States could have large negative regional repercussions. However Latin American financial markets do not seem to be anticipating a crisis. Since early July spreads on the Latin component of the EMBI+ have risen by about 90 basis points (a 48 per cent increase). While, this is a moderate increase when compared with the 800 point drop over the December 2002–June 2007 period, the future direction of country risk is not clear, yet.

<sup>13</sup> These issues are discussed in UNCTAD, *Trade and Development Report, 2007*.

**Central and Eastern Europe, Central Asia, the Russian Federation and Turkey**

33. Central and Eastern Europe is more closely linked to Europe than to the United States, and demand from euro-zone countries can be expected to slacken slightly. Countries with a large domestic absorption should not suffer much from this lower demand. More outward oriented economies are likely to suffer more.

34. Some Central European, Baltic, and Central Asian countries are running large current account deficits and could be severely hit by a jump in risk aversion and a sudden stop in capital flows.

**Asia**

35. Given their export orientation and the importance of the United States market, several East Asian countries are exposed to the vagaries of the United States economy. However, as the share of exports to the United States has decrease within the last couple of years, the GDP decline should be capped at 0.5 per cent.

36. Some Asian countries hold large assets denominated in United States dollars and a large depreciation of the United States currency could have negative fiscal implications for these countries.

**Africa**

37. A slow-down in the United States economy will impact sub-Saharan Africa mainly via a reduction of commodities exports. Most countries in sub-Saharan Africa have limited access to the international capital market and hence the potential increase in risk aversion should not be too damaging for these countries.

**Middle East and North Africa**

38. Most Middle Eastern and North African economies are particularly subject to changes in oil and gas prices (this is even the case for non-oil exporting countries which receive remittances, tourists, and economic aid from oil exporters). While a large drop in oil prices could slower growth in the region, the market does not seem to be expecting such a drop in prices. Official United States forecasts still project the oil price to be at around \$70 per barrel in 2008. The NYMEX crude oil futures which had declined by roughly 10 per cent since early August, started to recover in past weeks.

39. A few oil-exporting Middle Eastern countries are estimated to have substantial investment positions in the world capital market (hard data are difficult to obtain) and large decreases in asset prices could have negative wealth effects in these countries. The magnitude of these effects is, however, hard to estimate and it is more likely to affect long-term growth rather than having short-term cyclical effects.

**V. Lessons learned**

40. In thinking about policy recommendations, it is useful to distinguish between short-term and long-term measures. In the short-term, policy-makers should stand ready to mitigate the effects of the crisis and prevent contagion. In the long term, policy-makers should think about potential measures for preventing the recurrence of crisis. Long-term policies are likely to focus on the regulatory or supervisory frameworks. Of course, there might be an interaction between short and long-term

policies. For instance, some observers believe that short-term policies aimed at rescuing financial markets risk raising moral hazard issues and can lead to even larger future crises. Before discussing possible policies, it is worth reiterating that there are basically two interpretations of the current crisis:

- The first interpretation is that fundamentals are solid and the recent turmoil was a panic-driven liquidity crisis. Once confidence is restored, markets will have no problems in absorbing the relatively modest losses in the United States sub-prime mortgage market.
- The second interpretation is that we are now living a Minsky Moment which could lead to massive de-leveraging and have negative long-term effects on the United States economy (see annex F).<sup>14</sup> Those who believe in this view, suggest that there are deep problems with the current state of financial markets, assets are overvalued and financial institutions will soon realize that they are holding a huge amount of worthless paper. In this view, the current turmoil reveals a solvency crisis.

### A. Short-term policies

41. Accordingly, there are two views on short-term policy measures.<sup>15</sup>

42. Those who subscribe to the liquidity crisis view generally approve of the cash injections provided by the United States Federal Reserve and the ECB. Supporters of this camp believe that price stability should be a fundamental objective of modern central banks but also recognize that financial crises can lead to deep recessions and that preventing financial instability is crucial for stabilizing output fluctuations (Bernanke, 1983). According to this view, by cutting the discount rate while leaving Fed Funds rate unchanged the Fed has done exactly the right thing: it has given the signal that it stands ready to provide liquidity to financial markets, while assuming a conservative stance on the prospects of future monetary policy changes.

43. Central banks can also adopt actions aimed at reducing uncertainty. Most central banks like “constructive ambiguity”. While constructive ambiguity can play a useful role in reducing moral hazard, it generates problems when investors face deep uncertainty and start adopting worst-case scenario strategies. In such an environment, central banks can reduce uncertainty by clearly explaining how they will act if the worst-case scenario unfolds. If crises are driven by panic attacks, central banks can avoid panic by credibly promising large liquidity injections. If the market believes this promise, the liquidity injection will not be necessary because the run will be avoided.

44. While agreeing that central banks should provide the necessary liquidity, Willem Buiter and Anne Sibert have argued that standard monetary policy instruments are not valid tools for handling the current crisis. The argument goes as follows: as some of the financial instruments which are at the center of the crisis are not traded in liquid markets, central banks should act as market maker for these instruments. In other words, central banks should jump-start the market by standing

<sup>14</sup> George Magnus (2007) “What this Minsky moment means,” *Financial Times*, 22 August.

<sup>15</sup> There is also a third view that says that Central Banks should save markets, no matter what. Supporters of this view are rarely serious analysts.

ready to buy CDOs at a heavy discount (the discount is necessary to prevent moral hazard). Hence, rather than acting as a lender-of-last-resort, central banks should act as “market-makers-of-last-resort”.<sup>16</sup>

45. Several observers who subscribe to the solvency crisis view argue that looser monetary policy cannot restore solvency. Central banks should therefore focus on maintaining price stability and abstain from constantly rescuing the markets. Advocates of this view claim that central banks should stop serving as serial bubble blowers and that while a recession might be painful, lowering interest rates will create moral hazard and just delay the day of reckoning.<sup>17</sup>

46. However, even if the recent turmoil reflects fundamental problems with the working of the financial market and it is based on solvency problems, it is hard to think that cold turkey policies may work. Allowing interest rates to skyrocket is likely to be counterproductive and could lead to a situation in which liquidity problems amplify the solvency problems which are at the root of the crisis. The recent policy measures adopted by the major central banks thus appear reasonable. The real challenge, however, is to devise policy actions that punish those who were responsible for injecting the crisis while protecting innocent bystanders.

## **B. Long-term policies**

47. While the short-term response to the recent financial turmoil seems appropriate, there are legitimate questions as to whether there is something wrong with a system that, over the last two decades, has delivered a financial crisis every few years.<sup>18</sup>

48. Some observers claim that there is nothing wrong with the current system and that financial instability is just a collateral damage of an increasingly complex system that plays a positive role in allocating funds to activities which have the highest economic return. According to this view, financial disruptions are unpleasant, but overall financial engineering plays a positive role and accelerates GDP growth.<sup>19</sup>

49. Other observers claim that recurrent crises are driven by financial firms’ attempt to extract double-digit returns by manipulating claims on assets which have single digit returns. This financial alchemy, based on massive leverage and opaque instruments, does not have any positive effect on the real economy and leads to recurrent crises driven by the need of realigning the value of financial assets with that of the underlying real assets. While supporters of this view do not deny that finance plays a key role in the allocation of funds to high-return activities, they question the fact that financial deregulation always yields the best possible outcome.

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16 For a discussion supporting the current policies adopted by the Fed and ECB see Martin Wolf (2007) “The Federal Reserve must prolong the party”, *Financial Times*, 21 August. For details of the Buiter-Sibert proposal see Buiter and Sibert (2007) “A missed opportunity for the FED” <http://www.voxeu.org/index.php?q=node/481>.

17 For an illustration of this view, see Andy Xie (2007) “Time to end central banks bailout of markets”, *Financial Times*, 13 August.

18 The stock market crash in 1987, the S&L crisis in the early 1990s, the Mexican crisis in 1994/95, the Asian, Russian and LTCM Crises in 1997/1998, the corporate governance scandals in 2002, and the sub-prime crisis in 2007.

19 For an application of this view to Emerging Market countries see R. Ranciere, A. Tornell, and F. Westermann (forthcoming) “Systemic crises and growth”, *Quarterly Journal of Economics*.

50. Effective regulation can promote financial development while preventing financial engineering which leads to excessive risk-taking. Prudential regulation, however, needs to be comprehensive and should not focus on just one segment of the financial system. In the recent past, for instance, prudential regulation focused on banking activities and banks responded to regulation by hiding risk in lightly regulated non-bank institutions. Excessive financial engineering, SIVs, and so on are all answers to stricter regulation brought about by the Basel accord which aimed at increasing bank stability. Hence, any new regulatory proposal needs to try to anticipate the possible unintended consequences of more regulation.

51. Focusing on the current crisis, most observers agree that lack of transparency is at the root of the current crisis and that this lack of transparency is due to two factors: (i) securitization leads to a situation in which nobody exactly knows who is holding the risk associated with sub-prime mortgages and (ii) the real value of rarely traded structured financial products is not known.

52. Long-term policies should thus aim at increasing the transparency of structured financial products. This is not an easy task because, by their own nature, structured products are complex instruments. There are, however, a few steps that should be taken.

53. ***The role of credit-rating agencies:*** Credit-rating agencies, which should solve information problems and increase transparency, seem to have played the opposite role in this case and made the market even more opaque. These agencies played an important role in the creation of CDOs which were at the center of the recent crisis. Most observers are convinced that, because of conflict of interests, credit-rating agencies were too optimistic in rating CDOs.<sup>20</sup>

54. Rating is important because the crisis involved highly rated tranches of the repackaged debt based on sub-prime mortgages. The top tranches of CDOs based on sub-prime mortgages have received AAA ratings. AAA rating allowed the sale of these instruments to investors restricted by their internal rules to invest only in investment grade securities. However, it is questionable whether a top tranche CDO with an AAA rating carries the same risk-reward profile as a AAA-rated Treasury bond. As sub-prime is a fairly new market, there is little history on how this type of borrowers will behave during downturns. Thus, historical data is not available, making the modeling of default probabilities extremely unreliable.<sup>21</sup> Both the European and United States regulators are calling for inquiry to examine whether the data on sub-prime was robust enough to justify the ratings, whether caveats were issued and whether banks passed on accurate and sufficient information.

55. Rating agencies respond by affirming that their ratings include disclaimers that clarify that they are paid by the companies they rate and that ratings are only opinions and not accurate predictions of the risk of a given instrument. The problem is that rating agencies play an ambiguous role as the current regulatory environment renders rating decisions important in establishing what assets can be held by certain types of financial intermediaries. Moreover, rating agencies are not fully subject to

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20 A forthcoming UNCTAD discussion paper looks at how credit-rating agencies affect the market for sovereign debt.

21 However, rating agencies should have known that their CDOs rating were too generous. According to a Bloomberg report, Baa rated corporate bonds (this is the lowest Moody's investment grade rating) had an average default rate of 2.2 per cent. Over the 1993–2005 period CDOs with the same Baa rating had default rates of 24 per cent.

market discipline that would force them to increase the accuracy of their ratings because companies are obliged to use these agencies in order to place instruments.

56. A reform of crediting rating agencies and of their role in rating complex financial instruments is an unavoidable step towards increasing transparency. There are two views on how such reform could be implemented. Those who believe in market-based discipline, suggest that conflict of interests could be eliminated by removing the existing regulations which use credit ratings to determine the type of assets that can be held by regulated institutions.<sup>22</sup> While such a policy may have some benefits, it is not clear if it could fully solve conflict of interests. Issuers may still have incentives to suborn the rating agencies and the market mechanism may not work so well, especially if the ultimate risk is not borne by those (like pension fund managers) who choose the composition of a given portfolio of assets.

57. An alternative view favours the establishment of a regulatory agency which would supervise the role of credit-rating agencies. So, just as the FDA has to certify the safety of a given pharmaceutical products, such an agency could certify that an AAA asset has indeed minimal probability of default.<sup>23</sup> There are of course several issues with the design of such an agency. For instance, should this be a national or supranational agency? If it is a national agency, should assets rated as AAA in a given country be considered as AAA in other countries? How would such agency deal with political sensibility linked to rating sovereign bonds?

58. While these are important issues, it is worth noting that three agencies (one in the European Union, one in the United States, and one in Japan) would cover the majority of the world's financial assets and this would be the case even if these agencies were not allowed to supervise the rating of sovereign issuers.

59. ***Incentives for simpler financial instruments:*** Research shows that the current regulatory stance creates a bias in favour of sophisticated and opaque financial products. This should be modified by adopting regulations that favour simpler and more transparent financial products.

60. ***Maturity mismatches in non-bank financial institutions:*** Part of the crisis was due to the presence of maturity mismatches in non-bank agencies which enjoy liquidity guarantees from their parent banks. Regulation should limit the involvement of banks with these lightly regulated agencies which could transmit problems to the banking system.

61. ***Credit deterioration linked to securitization:*** Banks that quickly sell their loans are less interested in monitoring the quality of the borrowers. This problem could be mitigated by forcing banks to keep on their books a part of the loans they extend.

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<sup>22</sup> See Calomiris and Mason (2007) "A better way to judge risk", *Financial Times*, 23 August.

<sup>23</sup> The decisions of the agency could be made incentive compatible by committing to buy a given amount of the assets certified as AAA at a precommitted price.

## Annex A

### Chronology

**Background.** During the summer of 2005 there was an increase in the number of defaults on sub-prime mortgages in the United States. The problem has become more serious in 2006 and 2007.

*7 February 2007: New Century Financial and HSBC announce losses*

- New Century Financial, a specialized lender of sub-prime mortgage, announced that it had accumulated heavy losses during the previous three quarters.
- Likewise, HSBC announced heavy losses in its sub-prime segment.

*June 2007: Two Bear Stearns Hedge Funds announce funding problems*

- Two highly leveraged hedge funds run by Bear Stearns Asset Management experienced sustained losses due to the decline in the sub-prime mortgage market. Investors reacted to this announcement by requesting redemptions from the Bear Stearns Funds. Merrill Lynch and JPMorgan Chase asked for more collateral and called in their loans.
- Bear Stearns tried to sell around \$4 billion in mortgage-backed securities to raise funds to meet these demands, but did not immediately provide own capital to the funds. Eventually, one fund received a \$1.6 billion credit line to repay its lenders. Nevertheless, one of the hedge funds lost its total value, the other one lost 91 per cent.

*30 July 2007: First impact on Europe*

- “Rhineland Funding”, a conduit owned by the German IKB, with high exposure to sub-prime mortgage experienced funding problems.<sup>24</sup>
- Several public-sector banks, as well as private banks provided funds to rescue IKB.

*9 August 2007: PNB Paribas closes investment funds*

- PNB Paribas decided to freeze withdrawals by investors on three investment funds which have been invested in the United States mortgage market.<sup>25</sup>
- The value of these three funds declined by approximately 20 per cent between the end of July and the beginning of August (going from \$2.08 billion to \$1.6 billion).
- The week preceding this announcement, BNP Paribas presented its financial results for the first semester 2007 without notifying or even mentioning that the three funds were facing problems. This resulted in a significant fall of share prices of other financial companies and a general decline of the French CAC 40 index.

<sup>24</sup> A conduit is a special purpose vehicle or entity (SPV or SPE), which invests in ABS or MBS and raises funds by issuing asset-backed commercial papers (ABCP). These ABCP mostly have a short maturity of 30 to 60 days (see annex B).

<sup>25</sup> Parvest Dynamic ABS, BNP Paribas ABS Euribor and BNP Paribas ABS Eonia.

*9 August 2007: First central banks' intervention*

- Between 9 and 13 August the ECB injected €168 billion of liquidity in the European banking system (this happened after interest rates in the inter-bank money market had risen to 4.7 per cent). On 22 August, the ECB injected €40 billion into the three month money market.
- Between 9 and 16 August, the United States Federal Reserve provided \$57 billion of short-term liquidity to the banks. On 17 August, the FED reduces its Discount Rate from 6.25 per cent to 5.75 per cent but leaves the Fed Fund rate untouched at 5.25 per cent.
- The Bank of Japan provided ¥ 1 trillion of extra liquidity to the market.
- The Swiss National Bank, the Bank of Canada, and the Reserve Bank of Australia injected liquidity in the market.

*13 August 2007: Goldman Sachs provides capital to one of its hedge fund*

- Goldman Sachs injected \$2 billion of its own funds to bail out its Global Equity Opportunities hedge fund after the fund has experienced losses of 30 per cent of its value within one week. External investors injected further \$1 billion.

*Around 20 August 2007: Further problems concerning German banks*

- Ormond Quay, an Irish-based conduit owned by SachsenLB Europe, experienced difficulties in raising funds and its parent bank, state-owned SachsenLB, needed therefore an extra credit line of €17.3 billion provided by the publicly owned Sparkassen Finanzgruppe to avoid serious liquidity problems. As a consequence, SachsenLB has been taken over.

*22 August 2007: United States Banks access the discount window*

- Using the discount window is often considered as a signal that a bank has a problem. To diminish the stigma related to accessing the discount window four well capitalized United States Banks (Citigroup, JP Morgan-Chase, Bank of America, and Wachovia) borrowed \$500 million each from the discount window. The four banks pointed out that their step should be understood as a symbolic act in order to encourage other banks to do the same and thus to calm the market.

*26 August 2007: Turmoil has also an impact on Chinese banks*

- Bank of China and Industrial and Commercial Bank of China disclosed their exposure to the United States sub-prime mortgage market due to total investments of \$12.5 billion. Their share prices decreased considerably in the aftermath of this announcement.

*6 September 2007: ECB leaves interest rate untouched.*

- The ECB leaves the interest rate at its former level of 4 per cent although inflation risk remains high. The ECB President stated that due to high uncertainty it would be preferable to wait for further information. Also on 6 September, the Fed injected further \$31.25 billion to the money market.

*14 September 2007: Northern Rock liquidity squeeze gets Bank of England into trouble*

- Northern Rock, a United Kingdom-based mortgage lender, suffered liquidity constraints due to decreased liquidity inter-bank money market, besides a minimal exposure to the United States sub-prime mortgage market. As a consequence of the turmoil in the United States mortgage market the inter-bank money market lost liquidity as banks tend to be less willing to lend money to each other.
- The Bank of England had to act as lender of last resort and provide an emergency credit line to Northern Rock. Mortgage could be used as collateral for this credit line, and not gilts, as usual. The Bank of England has been criticized for this behavior as it conflicts with very recent statements of the governor.
- Additionally, the Bank of England provided further liquidity by offering emergency credits securitized by mortgages to cash strapped banks, starting with an injection of £10 billion by 24 September 2007.
- Furthermore, the British Government provided guarantees on Northern Rock deposits.
- After the announcement of Northern Rock's liquidity problems, hundreds of savers withdrew their deposits, the withdrawals are estimated to reach about £1.5 billion.

*18 September 2007: Fed reduces federal funds target rate by 50 basis points*

- The Fed reduced the Federal Funds Target Rate for the first time since three years from 5.25 per cent to 4.75 per cent. This is 25 basis points more than expected by most observers and was understood as an attempt to stimulate economic growth. Stock markets worldwide reacted positively to this decision, while the United States dollar experienced further depreciation against the euro.

*20 September 2007: Differing consequences of market turmoil*

- Banks' figures for the third quarter 2007 are of particular interest as they are supposed to give an evidence of how the crisis affects banks' returns. While Bear Stearns announced heavy losses for the third quarter of 2007, Goldman Sachs and Lehman Brothers disclosed high returns.
- Still, the turmoil is ongoing: The Fed injected a further \$29 billion on 20 September and \$9.75 billion on 19 September.

## Annex B

### Structured investment vehicles

Over the last few years, several banks created non-bank subsidiaries known as conduits or structured investment vehicles (SIVs). Like banks, SIVs are in the business of transforming liquid liabilities into non-liquid assets and hence have a built-in maturity mismatch. However, rather than collecting deposits from the public, SIVs raise funds by issuing short-term asset-backed commercial paper (ABCP) and use the funds to buy long-term structured products, mostly, AAA tranches of collateralized debt obligations (CDOs).

Under regular market conditions, SIVs make profits thanks to the spread between the interest rate paid on short-term ABCP and the interest rate paid on long-term less liquid CDOs. However, if short-term interest rates increase or SIVs cannot raise cheap finance on the ABCP market, they can start accumulating losses. This would not be a big problem if SIVs were completely separated from the banking system. However, SIVs have either implicit or explicit agreements stating that, if a given SIV cannot raise its own finance, the bank that owns the SIV needs to provide an emergency credit line. In a sense, the parent bank is the lender of last resort of the SIV. However, unlike the traditional lender of last resort (the central bank), parent banks cannot create liquidity.

This is exactly what happened in the last few weeks. Suspecting that CDOs held by some European SIVs were of lower quality than previously thought, investors stopped buying ABCP issued by SIVs. Since SIVs could not roll-over their maturing ABCP, parent banks had to step in and finance their SIVs (credit lines provided by guaranteeing banks need to cover all ABCP issued by SIVs).<sup>26</sup> This had a snowball effect, because even banks which did not have to provide credit lines to their SIVs started hoarding funds in order to be able to honor their commitments if liquidity lines were to be called. By hoarding funds, these banks drained liquidity from the inter-bank market and provided further incentives to hoard liquid reserves. The problem was made even worse by the fact that most banks that needed liquidity were based in Europe but they needed United States dollar funds. Hence, they could not be helped by the European Central Bank (that can only issue euros). Knowing this, several United States-based banks stopped lending dollars to European banks.

Therefore, a system that was supposed to isolate banks from financial crises, put banks back at the center of the action and it did so through the operation of opaque and lightly regulated institutions like SIVs.

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<sup>26</sup> It is estimated that in August German banks owned €93 billion in ABCP conduits. The two largest participants in his market (IKB and Sachsen LB) were also the first two banks to have troubles.

## Annex C

### Structure of CDOs and the role of credit-rating agencies

Structured finance instruments can be defined by three key characteristics: (i) pooling of assets (either cash-based or synthetically created); (ii) tranching of liabilities that are backed by the asset pool (this property differentiates structured finance from traditional “pass-through” securitizations); (iii) de-linking of the credit risk of the collateral asset pool from the credit risk of the originator, usually through use of a finite-lived, standalone special purpose vehicle (SPV).<sup>27</sup>

A key goal of the tranching process is to create at least one class of securities whose rating is higher than the average rating of the underlying collateral asset pool or to create rated securities from a pool of unrated assets. This is accomplished through the use of credit support specified within the transaction structure to create securities with different risk-return profiles. The equity/first-loss tranche absorbs initial losses, followed by mezzanine tranches which absorb some additional losses, again followed by more senior tranches. Thus, due to the credit support resulting from tranching, the most senior claims are expected to be insulated – except in particularly adverse circumstances – from default.

Tranching contributes to both the complexity and risk properties of structured finance products. Beyond the challenges posed by estimation of the asset pool’s loss distribution, tranching requires detailed, deal-specific documentation to ensure that the desired characteristics, such as the seniority ordering of the various tranches, will be delivered under all plausible scenarios. In addition, complexity may be further increased by the need to account for the involvement of asset managers and other third parties, whose own incentives to act in the interests of some investor classes at the expense of others may need to be balanced.

Structured finance has largely been a “rated” market. Issuers of structured instruments wanted them to be rated according to scales that were identical to those for bonds, so that investors, some of whom were bound by the ratings-based constraints defined by their investment mandates, would be able and willing to purchase structured products.

Activities related to rating various structured products have become the largest and fastest growing business segment for the three leading credit-rating agencies. Around half the revenues of rating agencies are currently generated by rating structured finance products.<sup>28</sup>

The recent turmoil in the sub-prime market has led to a number of criticisms with regard to the rating of the tranches. First, there has been widespread dissatisfaction with the slow response by rating agencies to downgrade certain CDOs as the sub-prime crisis gathered momentum. Second, conflict of interests may prevent rating agencies from playing the role of impartial evaluators of credit risk. This conflict of interests is due to the fact that credit-rating agencies are paid by the banks and

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27 This paragraph and the next three are taken from the BIS (2005) paper “The role of ratings in structured finance: issues and implications.” A forthcoming UNCTAD discussion paper entitled “Rating the credit-rating agencies” discusses how credit-rating agencies affect the market for developing countries’ debt.

28 Data collected by David Evans of Bloomberg suggest that, over the past three years, Moody’s, Standard & Poor’s and Fitch have earned more money evaluating CDOs than from any other activity.

corporations that sponsor and issue bonds. Hence, issuers may choose agencies that are more likely to give them a high rating. Moreover, rating agencies are often involved in lucrative consulting activities aimed at advising issuers on how to structure a product in order to obtain a high rating.

## Annex D

### Quantitative hedge funds

Quantitative hedge funds (Quants) make trading decisions based on sophisticated computerized models. The first Quants were established in the 1980s by James Simons (who founded Renaissance Technologies in 1982) and David Shaw (who founded DE Shaw in 1988). Because of their high returns (over the last twenty years Renaissance Technologies' flagship fund had an average annual return of 30 per cent). Quants grew very rapidly and now they are thought to represent about one quarter of all United States equity hedge funds.

Originally, Quants used computer models to help analysts pick stocks. Modern Quants use computerized models to detect small anomalies in pricing of certain securities and automatically trade these securities. Hence, a large amount of trading in modern exchanges happens among computers which often have similar trading strategies. Automated trading leads to very rapid trading and Quants account for 50 per cent of daily trading in the United States stock market.

Markets were shocked when, in early August, several highly respected Quants (including James Simons' Medallion and Goldman Sachs' quant) announced large losses. While nobody knows exactly what went wrong in the recent crisis, Tett and Gangahar (2007) describe the following chain of events:<sup>29</sup> After some investment managers realized losses in the sub-prime mortgage markets, investment banks asked hedge funds to reduce their leverage. In order to obtain the necessary cash, hedge funds had to sell assets, but since mortgage-linked CDOs are not liquid, they decided to sell liquid high-quality equities. As the prices of high quality liquid assets started falling, other quant funds (which, in a credit crunch scenario, were programmed to go long on this type of assets and short on illiquid high beta stocks) started making losses as market prices were not confirming their assumptions. Hence, the margin calls and the need to sell high quality assets forced the market to do exactly the opposite of what models predicted. Losses were amplified by their high initial leverage and by the fact that most Quants worked with similar models.

This suggests that while automated trading works well when market conditions are "normal" (that is the probability distribution of the possible events can be approximated with a known probability distribution), computers have problems dealing with "black swans".<sup>30</sup> Computer programs base their decisions on past data and may not recognize that the past data are driven by their own trading activities. Moreover, automated trading programs tend to have similar trading strategies (because they are based on the same set of past information) and this may lead to herding. Thus, automated trading could not deal with exceptional volatility and forced selling. Computer models assume that trading is driven by valuation and not by liquidity needs, if trading decisions are not driven by valuation, computerized model become useless or, as it happened in the past week, predict the opposite of what the market will do.

Goldman Sachs announced that its Quant funds lost approximately 30 per cent of their value in a week. In its letter to investors Goldman Sachs announced that the

<sup>29</sup> Tett and Gangahar (2007), "Limitation of computer models", *Financial Times*, 14 August.

<sup>30</sup> Following Karl Popper, Nassim Nicholas Taleb calls "black swans" large-impact, hard-to-predict and rare events beyond the realm of normal expectations.

losses were due to a “25 standard deviation event”. A 25 standard deviation event is an event that can happen with a probability of 5 per cent. The probability of a 25 standard deviations event is infinitesimal: such an event should happen once every 100,000 years. The problem is that these “black swans” seem to be happening more often than they should (it was such an event that caused the LTCM collapse in 1998). This suggests that there must be something wrong with the models used to predict these events.

## Annex E

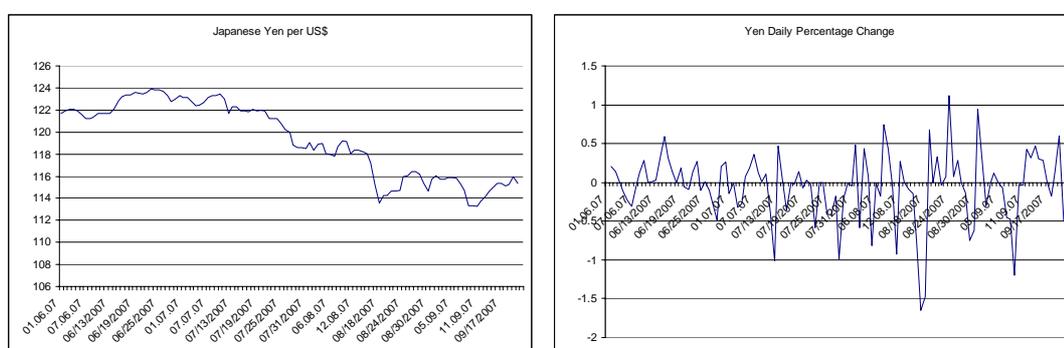
### The unwinding of carry trade

#### Yen/US\$ carry trade

Figure E1 shows the most recent trend in the yen/US\$ exchange rate and the rate of change yen/US\$ exchange rate. A strong appreciation of the yen, since the end of June, is associated with an increase in volatility yen/US\$ exchange rate.

**Figure E1. Yen per US\$ (left) and daily rate of change (right)**

(June 2007–21 September, 2007)



While the expectations of lower interest rates in the United States and higher interest rates in Japan are playing a role in these latest developments, the recent changes seem to be mostly driven by increasing currency market volatility and rising risk aversion.

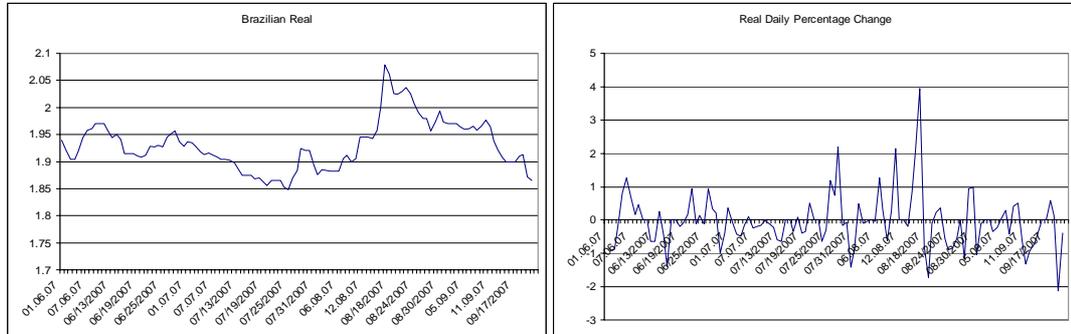
Currency volatility discourages carry trade operation by raising the risk that gains from interest rate differentials between the funding and the target currency may be eroded by exchange rate movements. This is amplified by the fact that the unwinding of positions increases volatility and the probability of appreciation of the low-yielding currency.

#### Carry trade in Brazil

The current market turmoil and increasing in risk aversion are also reducing the demand for emerging market assets and currencies. Currency carry trade towards the Brazilian real is partly unwinding despite a persistently large interest differential between Brazilian assets and the United States dollar (fig. E2).

**Figure E2. Brazil real per US\$ (left) and daily rate of change (right)**

(June 2007–21 September 2007)

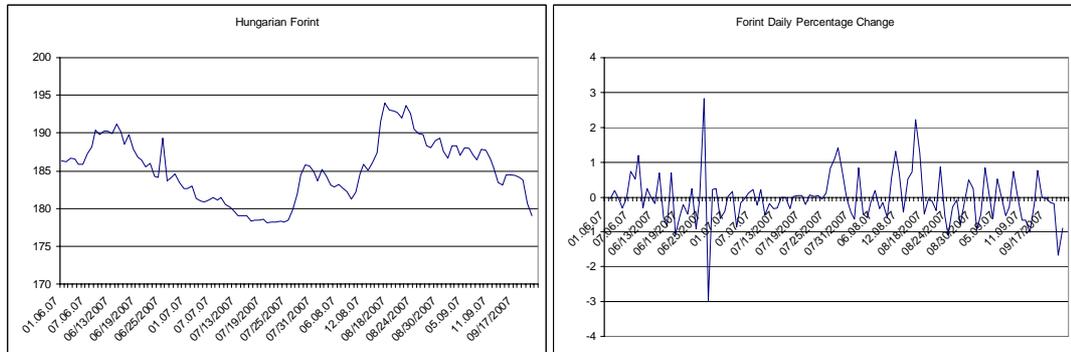


**Carry trade in Hungary**

A Swiss franc carry trade in Eastern Europe has funded a few regional property bubbles (in 2006 more than 80 per cent of Hungarian mortgages were denominated in Swiss francs). A sudden reversal of speculative flows can be behind the strong depreciation of the Hungarian forint (fig. E3) and generate defaults and falling house prices.

**Figure E3. Hungarian forint per Swiss franc**

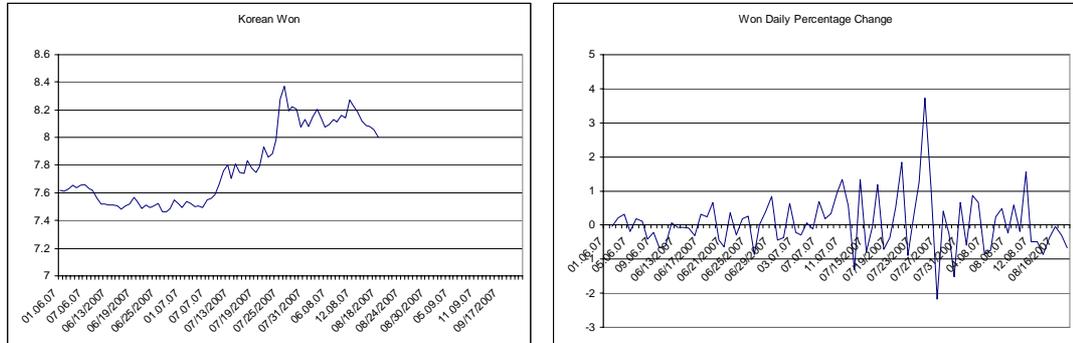
(June 2007–21 September 2007)



**Carry trade in the Republic of Korea**

The Bank of Korea estimates that during 2006 the flow of yen-carry trade funds amounted to \$6 pushing the stock of carry trade positions to \$29 billion (approximately 10 per cent of the Republic of Korea’s foreign exchange reserve). The sudden depreciation of the won (fig. E4) is likely to be driven by the liquidation of carry trade positions.

**Figure E4. Korean won per yen**  
(June 2007–21 September 2007)



## Annex F

### **Financial instability according to Hyman Minsky**

Hyman Minsky's model of credit cycles and financial fragility has provided a sound interpreting key of previous and most recent financial and economic booms and crises. The model builds on the Keynesian and Schumpeterian tradition and had been originally developed to explain credit and economic cycles in industrialized market economies with highly developed financial institutions and markets. The Saving and Loan-based real estate boom and bust in the late 1980s and the tech bubble and burst in the late 1990s, for instance, have been widely acknowledged as Minsky cycle episodes. However, the model's relevance to the contemporary world economy has been recently underlined by the series of financial crisis in developing and newly industrializing countries that followed the liberalization of domestic and international capital markets in the 1990s as well as by the current sub-prime loan-based credit crisis that is affecting industrialized economies and raising concerns for a number of emerging market economies.

A first element of Minsky's model is the distinction between three types of finance: hedge finance, speculative finance and Ponzi finance. Any economic unit such as household, firms or financial investor can operate as a hedge, speculative or Ponzi investor/borrower and switch from one type to the other according to the credit and macroeconomic conditions of the economy. The economic unit is defined as "hedge" if its operating income and cash-flow is sufficiently large to cover both interest payments and amortization of debt and eventually build up new assets. The speculative unit, on the other hand, can service only interest payments and uses new loans to finance amortization of old debt to buy new assets, while the "Ponzi unit", whose operating income does not cover interest and debt amortization, builds up new debt to meet its scheduled repayments of interest, amortization and pursue new investments. Many households and investors, both sub-prime and near-prime, became "speculative units" and were able to refinance their mortgages rather than paying their principal. Many were even allowed to become "Ponzi units" since they were not subject to any verification of income and assets or any down-payment.

A second element of the model is the role of credit expansion. Supply of credit is highly pro-cyclical and increases during economic booms while contracts during slowdowns. This can be due to various concomitant factors. During economic expansions investors expectations become more optimistic and less risk averse. Loans are obtained more easily and a process of leveraging sets in. Borrowing allows pursuing larger investment projects or highly speculative assets at rising prices. Investment, consumption, profit and growth rates surge. Financial innovation and the loosening of credit standards among supervisors and regulators can be a critical factor for credit expansion while allowing financial institutions to avoid prudential regulation and supervision during booms and bubbles. This has been particularly evident in the recent mortgage credit cycle and disinflation of housing prices bubble which has generated a large rate of defaults, foreclosures on sub-prime, near prime and non-conventional mortgages, bankruptcies of sub-prime lenders and a recession in the housing market generating a historical real estate price fall.

Indeed another critical element of the cycle is the market psychology leading to phases of "manic" acquisition of assets and real investment and market "euphoria".

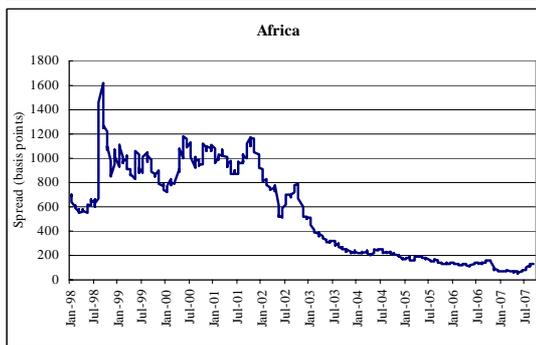
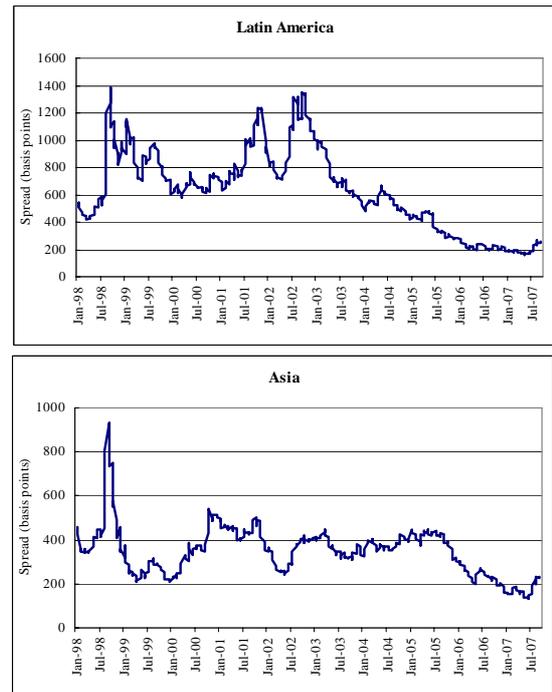
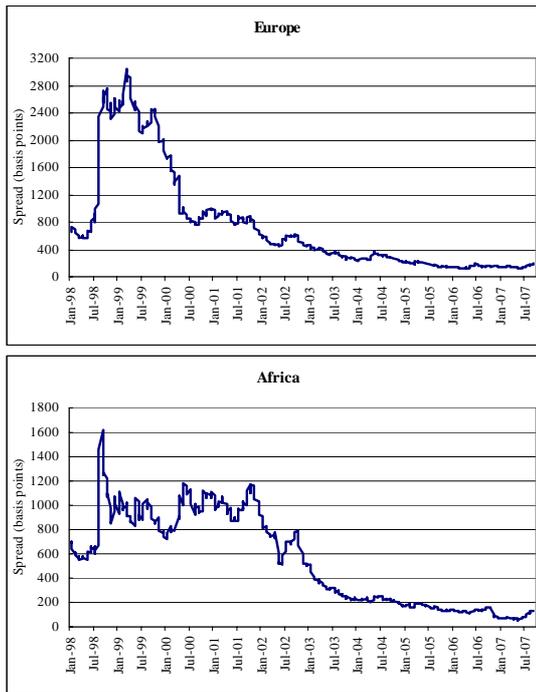
Banks may be reluctant to lose market shares and become eager to extend their credit to less creditworthy borrowers. Speculative acquisitions build up asset prices particularly in the real estate and stock markets; investment and consumption booms raise profits and income. Many of the mid and late 1990s United States and Asian crises as well as the current turmoil have been characterised by stock market and consumption booms fed by a concomitant real estate bubble. Euphoria can be propagated internationally through production networks, commodity price arbitrage, income spillovers via import and export linkages, and finally with speculative financial flows. Production and credit expand in both the originating and the affected economies. Firms and households become progressively more leveraged and switch from hedge finance to speculative finance. A progressive or sudden slowdown of the economic boom may lower asset returns and profits relative to interest rates and many units turn into Ponzi ones.

The slowdown of the boom can lead to “revolution”, panic and crashes. The overall financially fragile system breaks down facing chain series of defaults of Ponzi and speculative units that can no longer roll over their debts. Asset prices decline with investors flying to liquidity until the perception spreads that the price level is so low that might be profitable to buy less liquid assets or that sufficient amount of liquidity has been injected in the system to halt the fear of a liquidity shortage. In the latter case confidence needs to be restored by a national or international lender of last resort.

## Annex G

### Weekly EMBI+ spreads (by region)

January 1997–12 September 2007 (Source: Thomson Financial DataStream)



## Annex H

### Selected emerging markets stock market indices

January 1997–12 September, 2007 (Source: Thomson Financial DataStream)

